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SUBJECT: Provides addl info to support staff review of 981217 request for rev to TS SR 3.8.1.8,allowing for capability to manually transfer between preferred & alternate offsite power sources during modes 1 & 2 when required for equipment testing.

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U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
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Gentlemen:

Subject: **WNP-2, OPERATING LICENSE NPF-21**
REQUEST FOR AMENDMENT
TECHNICAL SPECIFICATION SR 3.8.1.8
ADDITIONAL INFORMATION

Reference: Letter GO2-98-215, dated December 17, 1998, GO Smith (SS) to NRC, "Request for Amendment - Technical Specification SR 3.8.1.8"

The purpose of this letter is to provide additional information to support staff review of the referenced request for a revision to Technical Specification Surveillance Requirement 3.8.1.8. The proposed change was requested to allow for the capability to manually transfer between the preferred and alternate offsite power sources during Modes 1 and 2 when required for equipment testing.

The surveillance is currently modified by a restriction in the form of a note which states that the automatic and manual transfer portions of the surveillance shall not be performed while in Modes 1 and 2. During follow-up discussions, the staff raised questions regarding the risk aspects due to transients that could potentially be induced by the manual transfer. Specifically, the staff questioned the possibility of a circuit breaker fault and its impact on the safety buses.

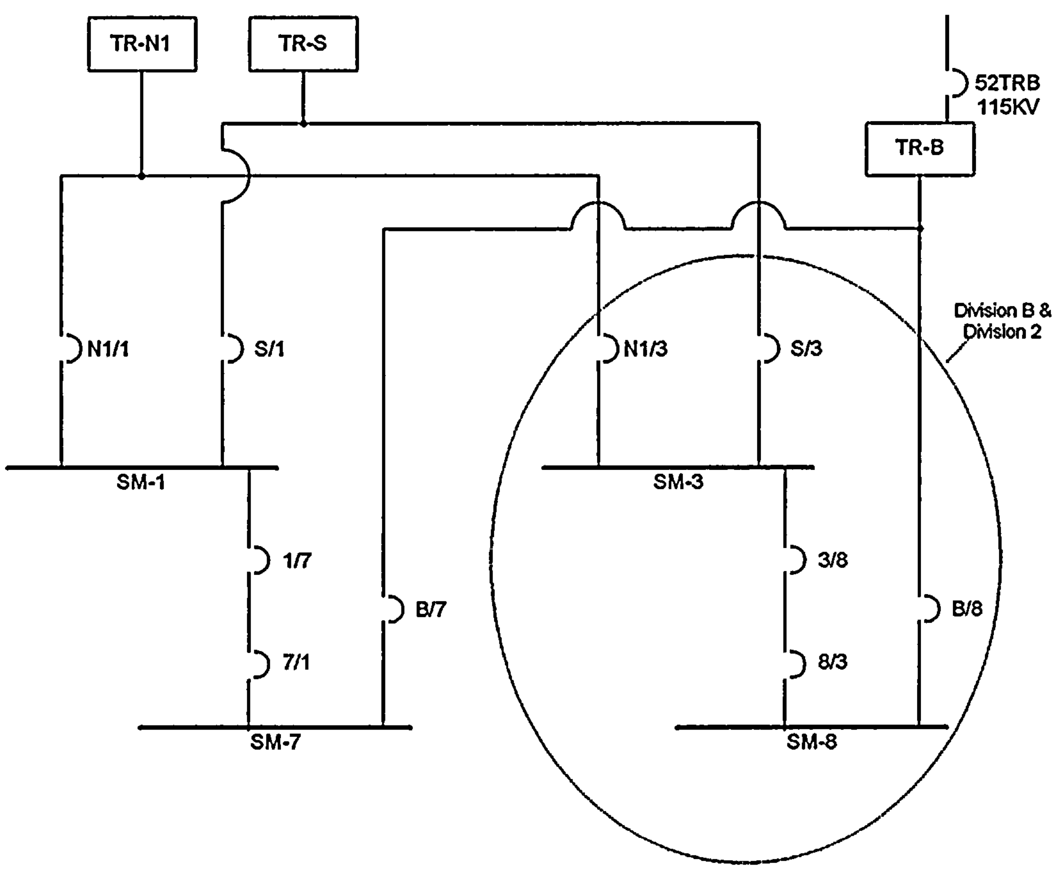
For ease of reference, a brief description of the AC distribution system is reiterated as follows. The AC distribution system includes the normal, startup and backup transformers, the emergency diesel generators, the 6900, 4160, 480 and 120 volt systems and associated transformers, switchgear and circuitry.

Station startup and shutdown power comes from a 230 kV offsite electrical grid through Startup Transformer TR-S. The startup transformer usually supplies station auxiliary loads when the main generator is not available. Station normal power is supplied from the main generator by means of Normal Auxiliary Transformers TR-N1 and TR-N2. Normal Transformer TR-N1 and Startup Transformer TR-S supply power to 4.16 kV Non-Critical Buses SM-1, SM-2 and SM-3. Normal Transformer TR-N2 and Startup Transformer TR-S supply power to 6.9 kV Non-Critical Buses SH-5 and SH-6.

When the main generator is ready, all station auxiliary loads are manually transferred from TR-S to TR-N1 and TR-N2. Normal supply to Critical Buses SM-7 and SM-8 is from Non-Critical Buses SM-1 and SM-3. Station backup power from a 115 kV offsite electrical grid through Backup Transformer TR-B can be supplied to Critical Buses SM-7 and SM-8. Emergency power from dedicated diesel generators can be supplied to Critical Buses SM-4, SM-7 and SM-8.

The proposed amendment would allow the manual transfer of SM-7 from preferred source SM-1 to alternate source TR-B, or transfer of SM-8 from preferred source SM-3 to alternate source TR-B when required for equipment testing. To address the staff's questions pertaining to the potential for increased risk due to transients induced by the transfer, an analysis was performed to define the initiating frequency for such a transient.

For ease of discussion, the following figure is included and represents a description of the Division 2 (Division B) electrical distribution scheme associated with a manual transfer between the preferred and alternate offsite power sources. The logic scheme and circuit breaker operation are identical for Division 1 (Division A).



During normal operation, circuit breakers 3/8 and 8/3 are closed and circuit breaker B/8 is open. When the manual transfer is performed, breaker B/8 closes and breaker 8/3 opens. If breaker B/8 fails to close, there is no transient because of the physical arrangement of the breaker logic. Contacts on breaker B/8 initiate the opening signal logic for breaker 8/3. Accordingly, if breaker B/8 does not physically close, there would be no signal to open breaker 8/3.

However, possible problems could occur if breaker B/8 closes and breaker 8/3 fails to open. If breaker 8/3 fails to open and results in a high cross connect current or fault between phases condition, either breaker B/8 or breaker 3/8 should open. Both breakers are designed to open on an overcurrent condition. If 8/3 fails to open and both B/8 and 3/8 subsequently fail to open, then it is possible for SM-8, SM-3 and TR-B to be isolated when breakers S/3 and 52TRB open to isolate the fault. The initiating frequency and conditional core damage probability for this set of failures has been calculated and is presented in the following Case 1 discussion.

If breaker S/3 fails to open, coupled with the simultaneous failure of breakers 3/8, 8/3 and B/8, then TR-S could be isolated as well. Therefore, this scenario results in the loss of SM-8, SM-3, TR-B and TR-S. The initiating frequency and conditional core damage probability has been calculated for this set of failures and is presented in the following Case 2 discussion.

- Case 1 - Loss of SM-8, SM-3 and TR-B

  This case consists of the failure of circuit breakers 8/3, 3/8 and B/8 to open. A failure of breaker 8/3 to trip following a manual closure of breaker B/8 could potentially result in paralleling of 230 kV and 115 kV sources for a sustained period. If the power flow between the two offsite sources results in a current in excess of the protective relay trip setting, breaker B/8 and/or 3/8 would trip, isolating SM-8 from one or both offsite sources. If the power flow between the two offsite sources results in a current less than the protective relay settings, then the control room operator could manually trip breaker 3/8 or breaker B/8 to isolate SM-8 from one of the offsite sources. If the current is less than the protective relay settings, no damage or transient occurs, even though all three breakers fail to open. This risk assessment conservatively assumes that the current after breaker 8/3 fails to open will always be sufficient to damage equipment if a breaker is not opened (i.e., phase-to-phase or three-phase internal fault at breaker 8/3).

  An over current condition is sensed separately at each of the three breaker locations. The logic is designed such that over current conditions sensed at breaker 8/3 results in a trip signal to all three breakers. Over current sensed at breaker 3/8 results in a separate trip signal to breakers 8/3 and 3/8. Over current sensed at breaker B/8 results in another trip signal to breakers 8/3 and B/8. The sensing circuits are separate from the relays so that the failure of breaker 8/3 to open does not result in failure of the over current protection logic for that breaker.

A fault tree was constructed to determine the initiating frequency for a transient caused by the loss of these three breakers. The fault tree included the following failure modes: 1) mechanical failure of the breaker to open when required; 2) trip logic relay failures; 3) over current sensing relay failures; 4) loss of DC power to the logic circuits; and 5) common cause failure of the three breakers (which are identical in model and manufacturer). The fault tree probability is heavily dominated by the common cause failure probability of the three breakers.

The demand failure of a circuit breaker currently in the WNP-2 Probabilistic Safety Assessment (PSA) is 1.53E-3, which is based on using the NUREG/CR-2815 failure rate and modified with plant specific data by means of the Bayesian update method. The common cause failure probability for the three breakers was derived using multiple greek letter methods with parameters obtained from NUREG/CR5497, and was determined to be 3.25E-5.

A fault tree was developed to obtain the multiple circuit breaker failure probability due to independent random failure based on the logic stated above. The total failure probability for the random failure of the three circuit breakers or the associated trip logic is 8E-7. WNP-2 has an experience base of more than 5000 cycles on 4160 V breakers with only a single failure to open event (maintenance restoration error). From the 14-year operating data (including the plant startup), the total cycling frequency for the main bus circuit breakers is in the range of 240 to 663. Almost all of these cycles occurred during startup testing or during Modes 4 and 5 when there is a higher power load on SM-8 than there is during Mode 1, 2 or 3. In Modes 1, 2 and 3 the power load on the critical buses is very low compared to the capacity of the breakers. The probability of the failure of all three breakers to open on demand is 3.31E-5 (= 3.25E-5 + 8E-7).

It is expected that evolutions where the manual transfer of a critical bus to TR-B is prudent (e.g., the current need to test CW-P-1C after repair) will be infrequent. When aligned to TR-B during Mode 1, 2 or 3, voluntary entry is made into a 72-hour Technical Specification LCO for loss of one offsite source because there is no automatic transfer capability from TR-B back to TR-S. It is also expected that when this situation arises, the total number of manual transfers that will take place during the testing is in the range of four to ten. For this evaluation, it was assumed that a critical bus is transferred from TR-S to TR-B ten times a year while the plant is in Mode 1, 2 or 3. Therefore, the initiating frequency is 3.31E-4/yr (= 3.31E-5 * 10/yr).

The impact to the core damage frequency was analyzed by developing a new transient event tree for the above event. While recovery could be as simple as racking out breaker 8/3 or breaker B/8 in most cases, no recovery actions were modeled in the event tree.

With SM-3, SM-8 and TR-B out of service, the conditional core damage probability was determined to be 1.61E-3. Therefore, the contributions of core damage frequency calculated from the event tree for this scenario is 5.33E-7 (= 3.31E-4*1.61E-3).

- Case 2 - Loss of SM-8, SM-3, TR-B and TR-S

  This event consists of the failure of circuit breakers 8/3, 3/8, B/8 and S/3 to open. The additional loss of TR-S could only occur if breaker S/3 failed in addition to the breaker failures listed in Case 1. Breaker S/3 (4160 V) is a significantly larger breaker than the feeder breakers to SM-8. Breaker S/3 is a 3000 amp breaker and the other three are 1200 amp breakers. For this reason, the failure of this breaker is modeled as an independent event, rather than a fourth common mode breaker failure. The over current sensing and trip logic circuit for breaker S/3 is independent of the other three breakers. Based on a fault tree considering the mechanical failure of the breaker, logic relay failure, logic circuit power failure, and sensing relay failure, the S/3 breaker failure is calculated to be on the order of 8E-3.

  Combining this with the initiating frequency determined for the failure of 8/3, 3/8 and B/8, and again using a value of ten cycles per year, the breaker failure rate was determined to be 2.66E-6/yr (= 8.04E-3 * 3.31E-5 * 10/yr).

  The impact to the core damage frequency was analyzed by developing a new transient event tree for the above event. Again, while recovery could be as simple in most cases as racking out breaker 8/3 or breaker B/8 and repowering SM-8, no recovery actions were modeled in the event tree.

  With SM-3, SM-8, TR-B and TR-S out of service, the conditional core damage probability was determined to be 0.11. Therefore, contributions of core damage frequency calculated from the event tree with these components out of service is 2.93E-7 (= 2.66E-6 * 0.11).

  Accordingly, the sum of the events from the postulated manual switching initiator is 8.26E-7 or 4.7 percent of the current Level 1 PSA core damage frequency. This is an acceptable risk based on EPRI/NEI PSA Applications Guide EPRI TR-105396.

  The baseline core damage frequency for WNP-2 is 1.72E-5/yr. According to the EPRI/NEI PSA Applications Guide, a permanent change being considered would be non-risk significant if the change in core damage frequency is less than 24.11 percent, which corresponds to a core damage frequency change of 4.15E-6/yr. Therefore, the risk is acceptable if the circuit breaker cycling frequency is less than 50/yr [= 4.15E-6 / (3.31E-5 * 1.61E-3 + 8.04E-3 * 3.31E-5 * 0.11)].

In summary, the transient analysis is conservative in many respects. First, the analysis assumes that, if breaker 8/3 fails to open and breakers 3/8 and B/8 subsequently fail to open, the failure mode will also be a phase-to-phase or three-phase internal fault and will always result in the loss of buses SM-8 and SM-3 and the offsite 115 kV source through TR-B.

However, this is not true for many types of breaker failures. If the failure to open is simply a failure of the breaker to open, with no high current fault, it is probable that no transient or loss of equipment would occur. Even if the current flow due to the cross-connection is sufficient to initiate over current protection, either breaker S/3 or breaker 52TRB will open first, leaving SM-8 powered by means of the other source. Power would still be available to both critical buses from at least two sources (a significantly less severe scenario than in the event trees developed for Cases 1 and 2).

Also, no credit is taken for the fact that in Modes 1, 2 and 3, the power load is very low on the critical buses, making the required opening action a light duty demand on the breaker. Finally, even most high current fault failure modes result in damage that is confined to the breaker itself. Therefore, the bus could be recovered by racking a breaker out of its cubicle and repowering the critical bus from one of the other power sources. However, no recovery actions were modeled.

Based on the transient analysis, we determined that making the manual transfer less than 50 times a year does not pose an unacceptable risk increase. We also found that the common mode failure event heavily dominates the initiating frequency. However, the trip logic and breaker location design is failure tolerant and the contribution to risk from random failure during manual switching is negligible.

In addition, breaker preventive maintenance is performed in accordance with manufacturer's (Westinghouse) instructions and industry recommendations and operating experience. We are also an active member of the EPRI/NMAC Westinghouse DS and DHP Breaker Owners Group. Breaker inspections are performed once every four years and include breaker opening and closing timing, inspection, lubrication and specific measurement and adjustment activities.

As stated in the referenced letter, plant mode has no impact on the manual transfer between offsite AC power sources. The manual transfer of offsite power sources is a controlled evolution and the risk associated with the performance of this evolution while the unit is at power is not significant. The manual transfer function should not cause perturbations to the electrical distribution systems because this evolution consists of a make-before-break (bumpless) transfer.

Should you have any questions or desire additional information pertaining to this letter, please call PJ Inserra at (509) 377-4147.

Respectfully,

D.W. Coleman

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